

ABSTRACT

Being a good steward of the environment should be a lifelong goal. Students learn the first step in good stewardship by creating a wildlife habitat in the school courtyard or on school grounds to study ecology. Cooperative groups of students observe and record data from interactions between organisms and their environment. This natural community gives students an opportunity to use scientific process skills. Students will develop an ecological interactive diary, measure the growth of a population of organisms, and study the effects of abiotic factors. Students continue observations and data collection to confirm or disprove the prediction that consumption of seed decreased with the advent of fall seed production.

LEARNING OBJECTIVES

Students will learn to

- ◆ weigh and record the amount of birdseed consumed each week by the birds;
- ◆ collect precipitation data during the school year using a rain gauge;
- ◆ classify birds and study bird biology and behavior; and
- ◆ describe the seasonal changes in the plants, animals, and ecosystem.

TIES TO CURRICULUM

This lesson satisfies several components of the *National Science Education Standards*. Students formulate predictions, and plan and implement simple experimental investigations to test those predictions. They collect information by observing and measuring habitat dynamics, and identify events and describe seasonal changes in the habitat. Finally, students compare adaptive characteristics of bird species, and communicate their conclusions.

NUMBER OF LAPTOPS AND GROUP SIZE

Each of four field stations needs one laptop computer. The class is divided into four groups, and groups rotate to a new station each month.

TIME REQUIREMENT

Conduct *Habitat Dynamics* for the whole semester. Besides one-time teacher preparation of about one hour, use 30 minutes each week (at the same time of day) to collect data. The next semester, a new group of students can continue the work for a four-month period (January–April or September–December).

Task	Time	Location
Introduction	30 minutes	Classroom
Activity	30 minutes per week	Field
Data compilation and analysis	3 hours	Classroom/homework
Report	45 minutes	Classroom

LESSON DESCRIPTION

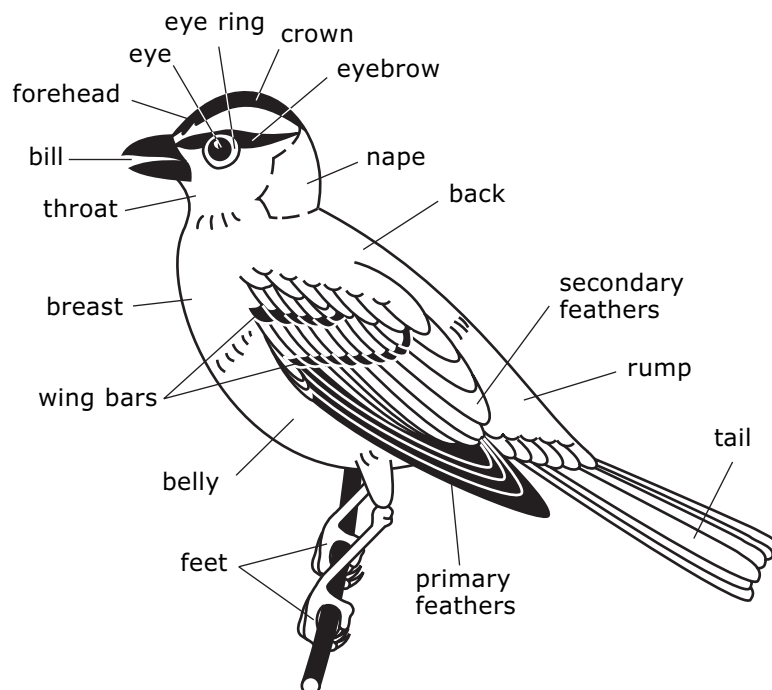
MATERIALS

- ◆ Laptop computers
- ◆ Word processing and spreadsheet software
- ◆ Field guide to birds
- ◆ Binoculars
- ◆ Bird seed (several types)
- ◆ Bird feeders (squirrel-proof)
- ◆ Flagging tape
- ◆ Scales
- ◆ Rain gauge
- ◆ Thermometer
- ◆ Measuring tapes and rulers

Teacher Preparation

Choose four study sites close to school, preferably on school grounds, to serve as ecological habitats. Set the limits of each study site by tying flagging tape around a plant in each corner of the site. Sites should be approximately 3 x 3 meters, and at least 9 m apart. Choose sites with a variety of perennial plants, and with trees or bushes nearby to provide protection for birds at the feeders. Set up bird feeders one to two weeks in advance to attract birds to the study sites. Check feeders regularly and keep them full. Set up a chart assigning group numbers, research days, and research stations. Set up spreadsheets for each station (see Appendix).

Figure 1: Basic bird anatomy and field marks



Introduction

Introduce the activity, and describe the birds and plants of the ecological habitat. Discuss a prediction that birds' consumption of seed from the birdfeeder will decrease during the fall when bushes and plants produce seeds and berries.

Demonstrate how to use a rain gauge. Photocopy the bird diagram in Figure 1, or make an overhead, and review the key characteristics of birds. Introduce students to using a field guide to identify birds. Point out characteristics and field marks of a bird: size, shape, structure of wings, beaks, and feet, and wing bars, eye-rings, tail spots and rump patches all distinguish species.

Activity

Divide the class into four groups. Groups observe one of four research stations at the same time of day once a week for a four-month period. Assign student roles within the groups: the *crew chief* supervises the group and asks the teacher questions, the *technical assistant* is responsible for tools, the *librarians* handle the field guides, resource material and worksheet, and the *reporter* records the group's observations on the laptop computer. Rotate these roles weekly so each student has an opportunity at each task.

At Station One, students observe seasonal changes in plants and bird feeding rate. Students use the word processor to compile journals of observed changes in plants over a five-month period.

To measure feeding rate, students fill the feeder with birdseed at the beginning of each week, weigh the feeder and seed (try to keep the seed weight constant at the beginning of each week), and reweigh the following week. Students should use a table similar to Table 1 in the Appendix. After several months of data collection, students can graph data to show weekly birdseed consumption over time.

SUGGESTIONS

- ◆ You can conduct this lesson in an outdoor classroom, courtyard, or anywhere there is space for birdfeeders, a thermometer, and rain gauge.
- ◆ Wind and water erosion might move the small rock at the base of the plant, so expect some deviation in plant measurement.
- ◆ Try to account for vandals or animals such as rodents that might tamper with the feeders and skew the results.
- ◆ Review safety rules for measuring and weighing various materials, and warn students that some of the plants may have sharp leaves or thorns.

REFERENCES

Books

- Dunn, Jon L. *National Geographic Field Guide to the Birds of North America, Third Edition*. Washington, DC: National Geographic Society, 1999
- National Research Council. *National Science Education Standards*. Washington DC: National Academy Press, 1996.
- Peterson, Roger T. *A Field Guide to the Birds: A Completely New Guide to All the Birds of Eastern and Central North America*. New York: Houghton Mifflin, 1998.
- Peterson, Roger T. *A Field Guide to Western Birds*. New York: Houghton Mifflin, 1991.
- Robbins, C.S., Bruun, B, and H.S. Zimm. *A Golden Guide to Field Identification: Birds of North America*. Racine, WI: Western Publishing, 1966.
- Tomera, Audrey N. *Understanding Basic Ecological Concepts*. USA: J. Weston Walch, 1979.

Web sites

- American Birding Association. Regional and state bird checklists: <http://www.americanbirding.org/>

continued on p.5

At Station Two, students write a report on plant growth and animal interactions. Groups measure plant height for at least four perennials and monitor plant growth using the spreadsheet on the laptop. Tie a small piece of flagging tape around the plants to be measured, and measure those plants each week. Place the stick on a small rock at the base of the plant so measurements are taken from the same place each week. Groups can compile data to graph results at the end of the semester to show seasonal plant growth or damage from animals (see Table 2 in the Appendix). Using the word processor, compile a journal with observations about animal interaction (chewing on leaves or stems of any of the plants in the habitat, and dramatic declines in plant height). Students can write a report about the change in plant growth and habitat from animal interactions.

At Station Three, groups measure temperature and precipitation, and graph their results. Measure temperature in full sunlight, and record readings on the spreadsheet. Measure and record precipitation weekly, but in case of rain between data collection days, make a special trip to measure precipitation before evaporation can occur. If it is raining the day of data collection, measure precipitation as soon as the rain stops. At the end of the semester, groups can compile precipitation data, and create a computer-generated bar graph.

At Station Four, students will observe plant and bird communities. For the 30 minutes of data collection each week, students should sit quietly just outside the site, and observe bird activity and plant life within the site. At least two group members should record the number and type of birds present, and at least two students can make observations about plant life. Students can combine these observations with data from Station One to compare fall birdseed consumption with the amount of birdseed consumed before the plants began to produce berries and seeds. Students should also try to note what other animals (insects, mammals, etc.) frequent the site. Record all observa-

tions in a computer journal, and include computer-generated sketches (sketches can be made in Microsoft Paint or a similar program, and imported into the word processing program).

Data Compilation and Analysis

At the end of the semester, the class will compile data. Each group should create tables and graphs, and write a report discussing the semester's findings. Students should incorporate data from all four stations to discuss the prediction that birdseed consumption decreased with the advent of fall seed production. The teacher will monitor the groups and serve as a resource while they are working.

When groups have analyzed the data and written reports, each group gives a final presentation to another science class.

ASSESSMENT

Teachers assess student performance by observing groups at work during the field activity and during data analysis. Evaluate students' work habits and cooperation, as well as data collection, recording, analysis skills, and communication skills. Students should be able to record and understand the data at all four sites, and generate graphs based on those data.

REFERENCES, cont'd.

- BirdWatch Monitoring Project.
Students observe birds in a schoolyard habitat:
<http://earth.simmons.edu/birdwatch/birdwatch.html>
- Journey North. A global study of wildlife migration:
<http://www.learner.org/jnorth/>
- National Bird-Feeding Society:
<http://www.birdfeeding.org/>
- Peterson's Online. Identifying birds and tips on attracting birds to a birdfeeder:
<http://www.petersononline.com/>

APPENDIX

Table 1: Spreadsheet to use at Station One, and sample data

Date	Starting Weight of Feeder + Birdseed (kg)	Ending Weight of Feeder + Birdseed (kg)	Amount of Birdseed Consumed (kg)
Sep 06	1.36	0.91	0.45
Sep 13	1.32	0.87	0.47
Sep 20	1.38	0.91	0.47
Sep 27	1.36	0.92	0.44

Table 2: Spreadsheet to use at Station Two, and sample data.

Students should create several spreadsheets and measure plant height for at least four plants.

Date	Plant Height (cm)	Change in Height (cm)	Animal Interaction
Sep 06	43.18	—	
Sep 13	43.31	+0.13	
Sep 20	31.03	-12.28	chewing on leaves of other plants observed
Sep 27	31.92	+0.89	
Oct 04	33.50	1.58	